Appeal In The Matter Of Department Permits L-24572-24-C-N, L-24572-TF-D-N, L-24572-IW-E-N, L-24572-24-F-N and L 24572-TF-G-N // Approval for Oakfield Wind Project Expansion

- Licensee Exhibit L

  Evergreen Application, Section 7, Appendix 7-8 (Eagle Summary Report); Maine GenLead Application, Section 7, Appendix 7-4 (2010 Bald Eagle Aerial Flight Survey Memo)

Appendix 7-8
Eagle Summary Report

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

Between 2008 and 2010, Stantec Consulting Services Inc. (Stantec) completed aerial surveys for bald eagle (*Haliaeetus leucocephalus*) nests, surveys, raptor migration surveys and eagle activity surveys in association with the proposed Oakfield Wind Project Amendment (Project) in Oakfield, Maine (Appendix A).

This report includes a summary of the methods used for each survey and a summary of the findings for those surveys.

2.0 EAGLE NEST AERIAL FLIGHT SURVEY

2.1 METHODS

Stantec conducted aerial nest surveys for bald eagle nests during the nesting season (late April to mid June) in 2009 and 2010. Prior to the surveys each year, Stantec reviewed information provided by the Maine Department of Inland Fisheries and Wildlife (MDIFW) regarding known active and historic eagle nest locations near the Project area. Stantec also consulted with Charlie Todd of the MDIFW and Mark McCollough of the U.S. Fish and Wildlife Service (USFWS), who both confirmed that the aerial survey for that year was performed at an appropriate time of year and employed the appropriate methods. The survey timing and methodology was consistent with Guidelines for Building and Operating Wind Energy Facilities in Maine (USFWS Maine Field Office, November 2009). In compliance with United States Fish and Wildlife Service (USFWS) National Bald Eagle Management Guidelines (May 2007), Stantec also notified Mark McCullough of the USFWS Maine Field Office that flights were planned in the area surrounding the Project.

The survey consisted of low altitude passes from a single-engine aircraft, approximately 500 feet above ground level, along the shoreline of identified waterbodies. In 2009, waterbodies within a 3-mile radius of proposed turbine locations for the Project were surveyed based on recommendations made by MDIFW and USFWS. In 2010 the survey radius was increased to 4-miles to correspond with standards recommended in the USFWS Maine Field Office Guidance (November 2009) which states that, "four miles is an average distance that Maine bald eagles may be expected to travel". The shorelines of the ponds and rivers were surveyed for active or historic eagle nest sites. Locations of new nests identified were recorded with a Global Positioning System receiver. Incidental observations of adult and juvenile bald eagles were also recorded.

2.2 RESULTS

On April 30, 2009, Stantec, along with Mr. Todd of the MDIFW, conducted an aerial eagle nest survey of nine lakes within a 3-mile radius of proposed turbine locations for the project, including Mattawamkeag Lake, Upper Mattawamkeag Lake, Pleasant Lake, Skitacook Lake, Mud Lake, Meduxnekeag Lake (Drews Lake), Twomey Lake, Spaulding Lake, and Long Lake. Stantec also surveyed two known bald eagle nest locations on Mattawamkeag Lake and Drews Lake (Appendix A).

In 2009, no new active nests were identified within this search area. Stantec surveyed the known bald eagle nest locations on Mattawamkeag Lake and Drews Lake. The nest on Mattawamkeag Lake was found to be empty. The nest on Drews Lake (MDIFW Nest #344B) was found to be active, with one adult bald eagle observed in the nest. The adult bald eagle was sitting in a position indicating that it may have been covering hatched eaglets. However, no eaglets were observed in the nest. This nest is located east of the location shown on the MDIFW Essential Habitat Maps and is shown in Appendix A. No adult or juvenile bald eagles or bald eagle nests were observed on the remaining lakes and rivers within the aerial flight survey area.

In 2010, Stantec conducted aerial eagle nest surveys on May 5 and June 9. During the first flight on May 5, eleven lakes within a 4-mile radius of proposed turbine locations for the project were surveyed including Long Lake, Spaulding Lake, Timoney Lake, Cochrane Lake, County Road Lake, Gould Pond,

Meduxnekeag Lake (Drews Lake), Skitacook Lake, Mud Lake, Pleasant Lake, and Mattawamkeag Lake, as well as a stretch of the East Branch of the Mattawamkeag River (Appendix A).

During the first flight on May 5, Stantec did not identify any active bald eagle nests within four miles of the Project area. Stantec located a known bald eagle nest on Drews Lake (MDIFW Nest #344B), but this nest, which was active during the 2009 survey, was found to be empty. One adult bald eagle was seen perched near the nest location. Stantec searched for an alternate nest location on Drews Lake (Nest #344A) but was unable to locate a nest. Stantec also located a known bald eagle nest on Mattawamkeag Lake (MDIFW Nest #143), but the nest was also found to be empty. Two adult bald eagles were seen perched in a neighboring tree. No other bald eagles or nests were observed in the Project area.

During the second flight on June 9, Stantec surveyed the nest locations identified during the first flight on Mattawamkeag Lake and Drews Lake. Both nests were found to be empty. Stantec also surveyed the shoreline of Drews Lake but no new nests were observed. An adult bald eagle was observed near the mapped 344A nest site, but no nest was observed in this area.

3.0 RAPTOR MIGRATION SURVEY AND EAGLE ACTIVITY SURVEY

3.1 METHODS

Raptor migration and eagle activity surveys were conducted over three years at three locations in the Project area: Sam Drew Mountain (2008, 2009, 2010), which provided good views to the south, east and west;[1] May Mountain (2009, 2010)[2], which provided good views in all directions; and Hunt Ridge (2010)[3], which provided good views in all directions. During surveys, a Stantec biologist scanned the sky and surrounding landscape with the unaided eye and binoculars to search for eagles and other raptors. Surveys were conducted in a variety of weather conditions, although the majority of survey days were targeted for mostly clear days with good visibility. Surveys were conducted for at least seven hours per day, typically from 9 am to 4 pm, during the peak hours of thermal development and raptor movement. The flight paths and approximate flight height, including time directly over the Project ridge, as well as age and behavior, were recorded for each eagle or raptor observed. For each observation, the horizontal flight path and vertical flight height[4] were documented. Because each bird could be observed in multiple locations during their flight path, the number of flight positions may be greater than the number of eagles observed. The observations were summarized by survey day and for the entire survey period. Vertical flight heights were compared to the maximum turbine height of 140 meters [m] (448 feet ['']).

The results of each survey are discussed below and are summarized in Appendix B, Tables 1-5.

3.2 EAGLES DOCUMENTED DURING RAPTOR MIGRATION SURVEY 2008

In 2008, Stantec conducted 12 days (79 hours) of raptor migration surveys in spring. Spring surveys were conducted between April 25 and May 30. Fall surveys were conducted on 12 days (84 hours) from August 26 to October 14. Both spring and fall surveys were conducted from the meteorological (met) tower opening on Sam Drew Mountain. During spring 2008, one bald eagle was observed flying along the lower slope of the ridge and above the valley. During fall 2008, four bald eagles were observed. Each eagle was observed within the Project area at varying heights and positions (Appendix B, Table 2). These five observations include two adults, two subadults, and one juvenile.

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[1] Views down into the valley to the northwest were obstructed due to the nature of the gradually sloping terrain and vegetation. However, the observer was able to see over the tops of surrounding trees to account for raptors flying at eye level or higher over the northwestern valley.

[2] Following surveys conducted in 2009 and 2010, the project layout was revised and no longer includes turbines within the vicinity of this location. Surveys were discontinued after April 13, 2010.

[3] The Hunt Ridge site was added in 2010, based on changes in the project layout.

[4] Vertical flight height was compared to the proposed maximum turbine height of 463 feet (141 meters)

For each observation, the horizontal flight path and the vertical flight height were documented. Because each bird could be observed in multiple locations during their flight path, a total of seven flight path locations were documented. Two flight paths were parallel to the ridge and included flight heights below maximum turbine height for some portion of their flight path over the ridge.

No bald eagles were observed on 19 of 24 days. The bald eagle passage rate was 0.01 eagles/observation hour in the spring and 0.05 eagles/observation hour in the fall.

3.3 Eagles Documented During Eagle Activity Survey 2009

In 2009, USFWS requested an additional 15 calendar days of surveys be conducted between late June and mid-September to further characterize eagle use in the Project area. In particular, USFWS requested that the additional surveys focus on eagle activity during nesting and dispersal periods and any ridge crossings between Spaulding Lake and Drews Lake. Surveys were conducted from two locations: Sam Drew Mountain and May Mountain.[5]

3.3.1 Summer – Fall 2009

Sam Drew Mountain
From July 9 to September 10, 2009, Stantec conducted 16 days (128 hours) of eagle activity surveys from the met tower opening on Sam Drew Mountain, at the same location as previous surveys conducted in spring 2008 and fall 2008. During this time, seven observations of bald eagles were documented, all of which were observed within the Project area at varying heights and positions (Appendix B, Table 3). These seven observations include four adults, two subadults, and one juvenile. Five of these observations occurred between 10 am and 1 pm. Six of these observations included linear and/or circle soaring behavior. On 11 of the 16 days, no bald eagles were observed. The bald eagle passage rate was 0.05 eagles/observation hour within the Project area.

A total of ten flight path locations were documented, all of which were inside the Project area. Five flight paths were over the ridge, four of which included flight heights below maximum turbine height for some portion of the flight path; two were below maximum turbine height and were parallel to the ridge, and three were perpendicular to the ridge. For these five flight paths, the total flight time over the ridge was 9 minutes, which is 0.1 percent of the total observation time during the season. Four flight paths were along the slope of the ridge, two of which included flight heights below maximum turbine height for some portion of the flight path. One flight path was over the valley at a flight height greater than maximum turbine height. No flight paths were indicative of crossings between Spaulding Lake and Drews Lake.

May Mountain
From August 24 to October 16, 2009, 15 days (106.5 hours) of eagle surveys were conducted from the met tower opening on May Mountain (also known as Robinson Mountain). During this time, seven observations of bald eagles were documented, none of which were observed within the Project area (Appendix B, Table 3). The bald eagle passage rate was 0.07 eagles/observation hour for the entire survey period and 0.00 eagles/observation hour within the Project Area. No eagles were observed flying over the ridge at heights below maximum turbine height.

3.4 Eagles Documented During Eagle Activity Survey 2010

In 2010, Stantec conducted an additional 35 calendar days of survey between mid-March and mid-October to further characterize eagle use in the Project area. Surveys focused on eagle activity during early migration, nesting and dispersal periods, and were conducted from three locations: Sam Drew Mountain, Hunt Ridge, and May Mountain[6].

[5] Following surveys conducted in 2009 and 2010, the project layout was revised and no longer includes turbines within the vicinity of this location. Surveys were discontinued after April 13, 2010.
[6] Ibid.

3.4.1 Spring 2010

Sam Drew Mountain
From March 16 to May 28, 2010, 15 days (102.5 hours) of eagle surveys were conducted from the met tower opening on Sam Drew, at the same location as previous surveys in 2008 and 2009. During this time, 11 observations of bald eagles were documented, seven of which were observed within the Project area at varying heights and positions (Appendix B, Table 4). These seven observations include six adults and one sub-adult. Five of these observations occurred between 10 am and 12 pm. On nine of the 15 days, no bald eagles were observed. The bald eagle passage rate was 0.11 eagles/observation hour for the entire survey period and 0.07 eagles/observation hour within the Project area.

A total of 19 flight path locations were documented within the Project area. Five flight paths were over a project ridge, three of which were observed over Hunt Ridge at flight heights above maximum turbine height and two of which were observed above Sam Drew and included vertical flight heights below maximum turbine height for a portion of the flight path. For these five flight paths, the total flight time over a project ridge was 2 minutes and 5 seconds, and the total flight time over the ridge at heights less than maximum turbine height was 30 seconds, 0.008 percent of the total observation time during the season. Nine flight paths were along the slope of the ridge, three of which included flight heights below maximum turbine height. Five flight paths included portions over the valley, none of which included portions below maximum turbine height.

Hunt Ridge
From March 18 to May 27, 2010, 15 days (101 hours) of eagle surveys were conducted from the met tower opening on Hunt Ridge. During this time, 20 observations of bald eagles were documented, 11 of which were observed within the Project area at varying heights and positions (Appendix B, Table 4). These 11 observations include adults and two subadults, one juvenile, and one eagle of unknown age. Eight of these observations occurred between 10 am and 12 pm. On nine of 15 days, no bald eagles were observed. The bald eagle passage rate was 0.20 eagles/observation hour for the entire survey period and 0.11 eagles/observation hour within the Project area.

A total of 30 flight path locations were documented within the Project area. Eleven flight paths were over the ridge. Eight of these flight paths included flight heights below maximum turbine height for a portion of the flight path; two of these flight paths with heights below maximum turbine height were parallel to the ridge, and six were perpendicular to the ridge. For these eight flight paths, the total flight time over the ridge was 12 minutes and 30 seconds, and the total flight time over the ridge at heights less than maximum turbine height was 4 minutes and 40 seconds, which is 0.07 percent of the total observation time during the season. Thirteen flight paths were along the slope of the ridge, seven of which included flight heights below maximum turbine height for a portion of the flight path. Six flight paths included portions over the valley, three of which included flight heights below maximum turbine height for a portion of the flight path.

May Mountain
From March 16 to April 13, 2010, three days (21 hours) of eagle surveys were conducted from the met tower opening on May Mountain, at the same location as previous surveys in summer and fall 2009. During this time, no observations of bald eagles were documented. Based on a change in the project layout rendering the May Mountain site outside the project area, raptor observations were discontinued for the remainder of 2010.

3.4.2 Summer-Fall 2010

Sam Drew Mountain
From June 17 to October 14, 2010, 20 days (140 hours) of eagle surveys were conducted from the met tower opening on Sam Drew, at the same location as previous surveys in 2008 and 2009. During this time, 15 observations of bald eagles were documented, seven of which were observed within the Project area at varying heights and positions (Appendix B, Table 5). These seven observations included three adults, two sub-adults, one juvenile and one of undetermined age. The bald eagle passage rate was 0.11

eagles/observation hour for the entire survey period and 0.05 eagles/observation hour within the Project area.

A total of 15 flight path locations were documented within the Project area. Seven flight paths were over the ridge, three of which included vertical flight heights below maximum turbine height for a portion of the flight path; two of these flight paths below maximum turbine height were parallel to the ridge, and one was perpendicular to the ridge. Six flight paths were along the slope of the ridge, one of which included flight heights below maximum turbine height. Two flight paths included portions over the valley, neither of which were below maximum turbine height.

Hunt Ridge
From June 17 to October 14, 2010, 20 days (140 hours) of eagle surveys were conducted from the met tower opening on Hunt Ridge. During this time, 13 observations of bald eagles were documented, seven of which were observed within the Project area at varying heights and positions (Appendix B, Table 5). These seven observations include four adults, one sub-adult and two juveniles. Two of these observations occurred between 10 am and 12 pm. On 11 of 20 days, no bald eagles were observed. The bald eagle passage rate was 0.09 eagles/observation hour for the entire survey period and 0.05 eagles/observation hour within the Project Area.

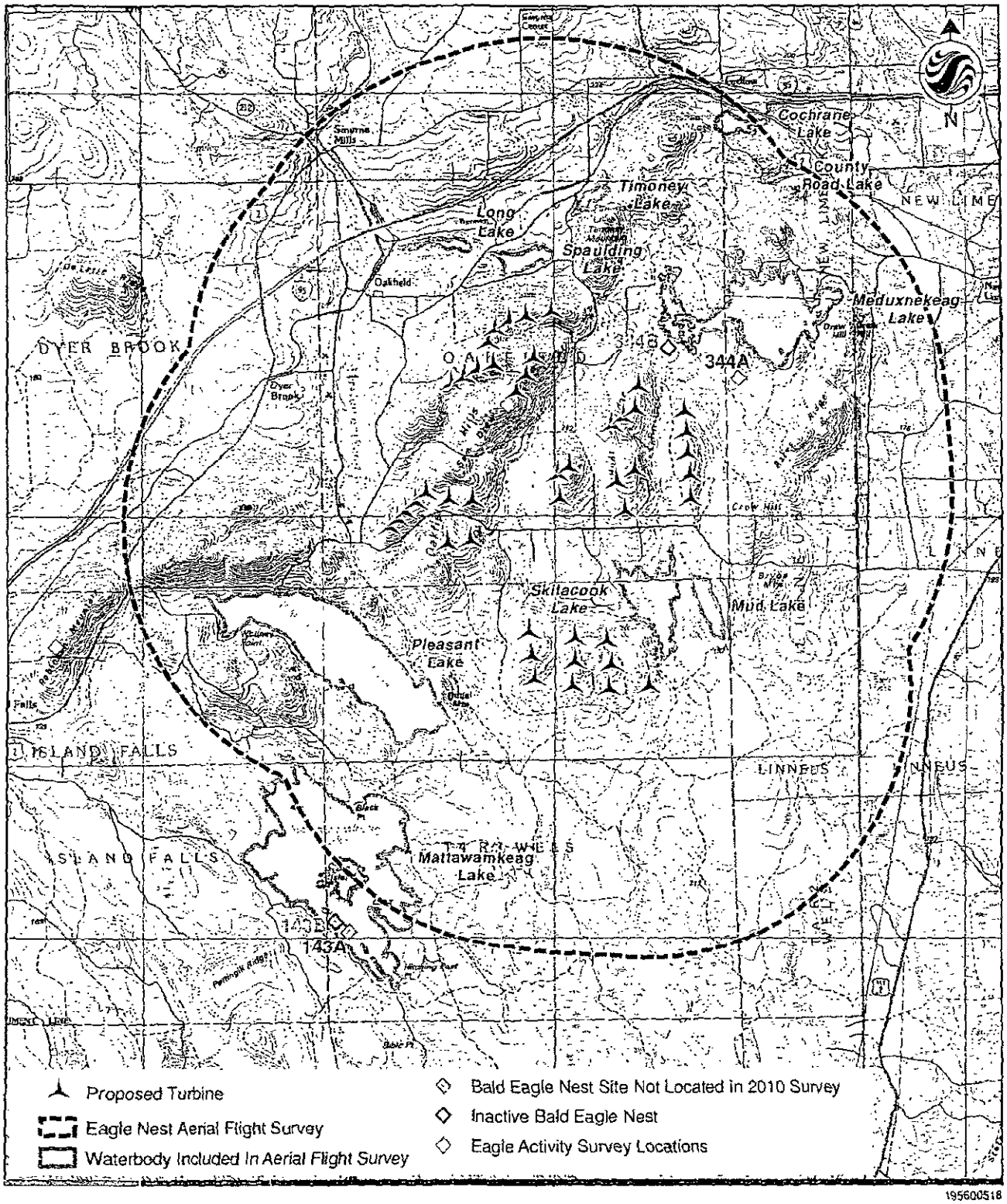
A total of 26 flight path locations were documented within the Project area. Nine flight paths were over the ridge, eight of which included flight heights below maximum turbine height for a portion of the flight path; four of these flight paths with heights below maximum turbine height were parallel to the ridge, and four were perpendicular to the ridge. Thirteen flight paths were along the slope of the ridge, eight of which included flight heights below maximum turbine height for a portion of the flight path. Four flight paths were over the valley, three of which included flight heights below maximum turbine height for a portion of the flight path.

4.0 CONCLUSION

One bald eagle nest site is located within four miles of proposed turbine locations. This nest was active in 2009 and was inactive in 2010. Eagle activity surveys were conducted for a total of 128 days (900 hours) during three years (Appendix B, Table 1), resulting in an overall bald eagle passage rate within the Project area of 0.05 eagles/hour which is less than the typical rate observed at other survey locations.

The findings from these surveys should be interpreted within the context of the best available information about bald eagle interactions with wind projects (Appendix C). Post-construction studies and other literature on raptor collision mortality in the eastern United States have documented fewer than 40 raptor fatalities reported during 15,000 turbine searches and suggest that raptors are not vulnerable to collision at modern wind facilities. Although fatalities of related eagle species have been documented at several facilities outside the United States, these generally occur in geographic settings that are significantly different than that at Oakfield (Appendix C).

Appendix A
Survey Location Map



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Client/Project
Oakfield Wind Project
Oakfield, Maine

Figure No.
1

Title
Bald Eagle Survey Map

11/16/2010

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Appendix B
Summary of Survey Results

Appendix B Table 1. Summary of Bald Eagle Observations at Proposed Oakfield Wind Project 2008-2010					
	Days	Hours	Bald Eagles Observed	Bald Eagles Observed within Project Area	Bald Eagle Observation Rate within Project Area
Sam Drew					
Spring 2008	12	79	1	1	0.01
Fall 2008	12	82	4	4	0.05
Summer-Fall 2009	16	128	7	7	0.05
Spring 2010	15	102.5	11	7	0.07
Summer-Fal 2010	20	140	15	7	0.05
Total	**75**	**531.5**	**38**	**26**	**0.05**
Hunt Ridge					
Spring 2010	15	101	20	11	0.11
Summer-Fall 2010	20	140	13	7	0.05
Total	**35**	**241**	**33**	**18**	**0.07**
May Mountain					
Summer-Fall 2009	15	106.5	7	0	0
Spring 2010	3	21	0	0	0
Total	**18**	**127.5**	**7**	**0**	**0.00**
Overall Total	**128**	**900**	**78**	**44**	**0.05**

Appendix B Table 2. Summary of Bald Eagle Observations during Spring and Fall 2008 Surveys

Date of Survey	Survey Location	Hours of Survey	Number of Individuals Observed	Obs #	Within project boundary? (yes or no)	Time	Age (J, Sub-A or A)	min height (m) A1	max height (m) A1	min height (m) A2	max height (m) A2	min height (m) A3	max height (m) A3	min height (m) B	max height (m) B	min height (m) C	max height (m) C	min height (m) D	max height (m) D	Flight Behavior (code)	Azimuth	Minutes over ridge below max turbine height	Other behavior notes
5/1/2008	Sam Drew	7																					
5/2/2008	Sam Drew	7																					
5/7/2008	Sam Drew	7																					
5/9/2008	Sam Drew	7																					
5/10/2008	Sam Drew	7																					
5/13/2008	Sam Drew	7																					
5/14/2008	Sam Drew	7	1	1	Y	1:00-2:00	sub A									350	350	400	400	S	SE	NA	flew from ponds south and west
5/20/2008	Sam Drew	7																					
5/23/2008	Sam Drew	7																					
5/29/2008	Sam Drew	7																					
5/30/2008	Sam Drew	7																					
[illegible]																							
8/26/2008	Sam Drew	7																					
9/2/2008	Sam Drew	6	1	2	Y	11:12:00	J	80	80					150	150					D	N	NA	
9/3/2008	Sam Drew	7																					
9/11/2008	Sam Drew	7																					
9/17/2008	Sam Drew	7																					
9/18/2008	Sam Drew	7	1	3	Y	9:00-10:00	A									50	50	75	75	I,D	SW	NA	adult moving southwest over fields/valley from the north
9/29/2008	Sam Drew	7																					
9/30/2008	Sam Drew	7																					
10/9/2008	Sam Drew	7																					
10/10/2008	Sam Drew	7	2	4	Y	9:00-10:00	A,SII	50	75											D	S	NA	both direct soaring over ridgeline to south
10/13/2008	Sam Drew	7																					
10/14/2008	Sam Drew	7																					

2008 Summary

	Number of Hours	Number of Eagles	Number of Eagles within Project Area	Total Passage Rate	Project Area Passage Rate
Sam Drew Spring	79	1	1	0.01	0.01
Sam Drew Fall	82	4	4	0.05	0.05

Appendix B Table 3. Summary of Bald Eagle Observations during Summer-Fall 2009 Surveys

Date of Survey	Survey Location	Hours of Survey	Number of Individuals Observed	Obs #	Within project boundary (yes or no)	Time	Age (J, Sub-A or A)	min height (m) A1	max height (m) A1	min height (m) A2	max height (m) A2	min height (m) A3	max height (m) A3	min height (m) B	max height (m) B	min height (m) C	max height (m) C	min height (m) D	max height (m) D	Flight Behavior (code)	Azimuth	Minutes over ridge below max turbine height	Other behavior notes
7/9/2009	Sam Drew	8	0																				
7/10/2009	Sam Drew	8	1	1	Y	10:00-11:00	A							50	50					CS,LS	45	0	flying along slope of the eastern portion of the project to the north
7/15/2009	Sam Drew	8	0																				
7/16/2009	Sam Drew	8	0																				
7/25/2009	Sam Drew	8	1	2	Y	12:00-1:00	SubA			50	50			75	75					PF	10	1	flew right over north Met to the north
7/31/2009	Sam Drew	8	0																				
8/14/2009	Sam Drew	8	1	3	Y	10:00-11:00	SubA			120	120			150	150					LS/G	330	1	flew to the north doing semicircles then gliding over over ridgetop
8/19/2009	Sam Drew	8	0																				
8/21/2009	Sam Drew	8	0																				
8/25/2009	Sam Drew	8	0																				
8/26/2009	Sam Drew	8	0																				
9/1/2009	Sam Drew	8	0																				
9/2/2009	Sam Drew	8	1	4	Y	10:00-11:00	J	30	150											CS,LS	300	3	moving north along ridgeline, then along other ridgelines to north
9/2/2009	Sam Drew		1	5	Y	12:00-1:00	A	75	200					300	300					CS,LS	310	4	circled on thermal above ridge to north before slowly moving north in thermal
9/3/2009	Sam Drew	8	0																				
9/9/2009	Sam Drew	8	2	6	Y	3:00-4:00	A			500	500							800	800	CS	300	0	circled over slope perpendicular to ridgeline in easterly direction and then changed direction and circled over valley
9/10/2009	Sam Drew	8	0																				
8/24/2009	May Mtn	8	1	1	N	8:00-9:00	A											50	100	LS,PF,CF	NW		flying low to the south; resident? mobbed by crows
8/27/2009	May Mtn	8	0																				
9/1/2009	May Mtn	8	1	2	N	1:00-2:00	A											600	600	CS	NE		outside Project area
9/2/2009	May Mtn	7	1	3	N	11:00-12:00	J											1,000	1,000	LS,CS	SE		circle-soared upward gaining altitude then linear soared to the southeast; migratory behavior
9/9/2009	May Mtn	7	2	4	N	11:00-12:00	A									200	300			LS			circling together, climbing very high while circling out of range of binoculars
9/17/2009	May Mtn	7	0																				
9/18/2009	May Mtn	6.5	0																				
9/23/2009	May Mtn	7	0																				
9/24/2009	May Mtn	7	0																				
9/25/2009	May Mtn	7	1	5	N	10:00-11:00	A											100	100	CS	N		edge
10/1/2009	May Mtn	7	0																				
10/2/2009	May Mtn	6	0																				
10/8/2009	May Mtn	7	1	6	N	10:00-11:00	A											150	500	G,CS			passed over ridge separating lakes; outside project area
10/9/2009	May Mtn	7	0																				
10/16/2009	May Mtn	7	0																				

2009 Summer-Fall Summary

	Number of Hours	Number of Eagles	Number of Eagles within Project Area	Total Passage Rate	Project Area Passage Rate
Sam Drew	128	7	7	0.05	0.05
May Mtn	106.5	7	0	0.07	0.00

Appendix B Table 4. Summary of Bald Eagle Observations during Winter-Spring 2010 Surveys

Date of Survey	Observer	Survey Location	Hours of Survey	Number of Individuals Observed	Obs #	Within project boundary (yes or no)	Time	Species	Age (J, Sub-A or A)	min height (m) A1	max height A1 (m)	min height (m)A2	max height (m)A2	min height (m) A3	max height (m) A3	min height (m) B	max height (m) B	min height (m) C	max height (m) C	min height (m) D	max height (m) D	Flight Behavior (code)	Azimuth	Minutes over ridge below max turbine height	Ridge Time (min)	Other behavior notes
3/17/2010	SPM	Sam Drew	7	0																						
4/13/2010	PRB	Sam Drew	7	0																						
4/14/2010	SPM	Sam Drew	7	1	1	N	2:00-3:00	BAEA	A											1500	2000	CS	N			circle-soared on thermals over Higgins Brook Valley, north around ridge
4/20/2010	PRB	Sam Drew	7	0																						
4/23/2010	PRB	Sam Drew	6	1	2	Y	10:00-11:00	BAEA	A			210	210							450	450	CS	?	0:00	0:15	high circling over Hunt Mountain southwest; lost and could not observe direction of travel
4/27/2010	PRB	Sam Drew	7	1	3	Y	10:00-11:00	BAEA	A	310	350					350	350	350	350	350	350	CS, G	SSW	0:00	0:45	high over Hunt Mountain south; circling and moving in high glide well to south; may be 143-nest bird? circling high despite poor conditions for thermal development
4/27/2010	PRB	Sam Drew		1	4	N	1:00-2:00	BAEA	A									300	350	350	500	CS, G	SSW	n/a	0:00	moving south, high over valley (may have crossed south end of Sam Drew Mountain)
4/27/2010	PRB	Sam Drew		2	5	N	2:00-3:00	BAEA	A											450	450	G	NE	n/a	0:00	flying with osprey, well to north in Medux Region, gliding away
5/7/2010	PRB	Sam Drew	6.5	0																						
5/11/2010	PRB	Sam Drew	6.5	0																						
5/17/2010	PRB	Sam Drew	7	1	6	Y	2:00-3:00	BAEA	A			60	70			120	120	150	150	250	375	CS, PF, G	NNW	:05	:05	high circle over Phase I; glide north; Mattawamkeag Lake pair bird?
5/17/2010	PRB	Sam Drew	7	1	7	Y	2:00-3:00	BAEA	SAII	35	35					20	40					G	NE	:25	:25	moving north shortly after adult, much lower in elevation
5/22/2010	PRB	Sam Drew	7	1	8	Y	10:00-11:00	BAEA	A							70	90	100	250	250	250	G	SSW	:00	:00	up from Higgins and south-southwest toward Mattawamkeag Lake (just outside project area)
5/22/2010	PRB	Sam Drew		2	9	Y	11:00-12:00	BAEA	A			500	500			500	500	500	500	210	550	CS, AD, G	SE	:00	:40	cross Hunt Mountain and very high aerial displays (Matta pair)
5/24/2010	PRB	Sam Drew	7	0																						
5/25/2010	PRB	Sam Drew	6.5	0																						
5/26/2010	PRB	Sam Drew	7	0																						
5/28/2010	SPM	Sam Drew	7	0																						
3/18/2010	SPM	Hunt	5	0																						
4/2/2010	SPM	Hunt	6	0																						
4/14/2010	PRB	Hunt	7	1	1	Y	11:00-12:00	BAEA	SAIV	60	100											PF, G, HO	var	:20	1:30	moving south from Higgins to met clearing; hovered and moved back north to Medux
4/14/2010	PRB	Hunt		1	2	Y	2:00-3:00	BAEA	A			75	125			100	400	250	250	250	250	CS, G	W	:45	:45	moved west; sim ID
4/14/2010	PRB	Hunt		1	3	N	3:00-4:00	BAEA	A											300	750	CS, G	NE			same as #9?
4/19/2010	PRB	Hunt	7	2	4	N	2:00-3:00	BAEA	A											175	450	CS, G	SE			high circle over Higgins, one bird higher, glides down to second; both birds descend out of sight
4/22/2010	PRB	Hunt	7	1	5	Y	10:00-11:00	BAEA	A			70	110			225	225	300	300	200	550	CS, PF, G				
4/22/2010	PRB	Hunt		1	6	N	12:00-1:00	BAEA	A											100	375	CS, AD, D				
4/22/2010	PRB	Hunt		1	7	Y	1:00-2:00	BAEA	A	150	150					100	350	100	350	100	350	CS, G				
4/22/2010	PRB	Hunt		2	8	N	2:00-3:00	BAEA	A											175	350	CS, G				

Appendix B Table 4. Summary of Bald Eagle Observations during Winter-Spring 2010 Surveys

Date of Survey	Observer	Survey Location	Hours of Survey	Number of Individuals Observed	Obs #	Within project boundary (yes or no)	Time	Species	Age (J, Sub-A or A)	min height (m) A1	max height At (m)	min height (m)A2	max height (m)A2	min height (m) A3	max height (m) A3	min height (m) B	max height (m) B	min height (m) C	max height (m) C	min height (m) D	max height (m) D	Flight Behavior (code)	Azimuth	Minutes over ridge below max turbine height	Ridge Time (min)	Other behavior notes
4/26/2010	PRB	Hunt	7	1	9	N	9:00-10:00	BAEA	unkn											350	350	CS, G	NE	n/a	0:00	long-distance observation; lost quickly below trees
4/26/2010	PRB	Hunt		1	10	Y	10:00-11:00	BAEA	J			100	220					100	300			CS, PF, G	SSE	0:35	1:00	juvenile of unknown age (backlit and trees, not adult); relatively low flight south-southeast over ridge
4/26/2010	PRB	Hunt		1	11	N	1:00-2:00	BAEA	A											150	590	CS	NNW	n/a	0:00	high circle to north; moving away north-northwest; in thermal with osprey
4/30/2010	PRB	Hunt	7	0																						
5/2/2010	PRB	Hunt	7	1	12	Y	10:00-11:00	BAEA	SA II			65	75			60	150	100	175			CS, G	SW	0:35	0:35	lifting up over Morrison area and crossing Hunt Ridge
5/2/2010	PRB	Hunt		1	13	N	10:00-11:00	BAEA	A											200	450	CS, G	W	n/a	0:00	high circle and glide away to west (toward Timony and Spaulding Lakes)
5/2/2010	PRB	Hunt		2	14	Y	10:00-11:00	BAEA	A	85	160	45	45							100	300	CS, AD, G	SW	2:10	3:50	one eagle moving in from south; both circle over Higgins and back south; see map
5/2/2010	PRB	Hunt		1	15	Y	11:00-12:00	BAEA	unkn			100	115									PF, G	W	0:15	0:15	
5/2/2010	PRB	Hunt		1	16	Y	3:00-4:00	BAEA	A			175	175			100	300	150	300	150	300	CS, G	SW	4:20	0:40	circle Higgins Brook, cross Hunt Mountain north and move south toward Skitacook
5/3/2010	PRB	Hunt	6.5	0																						
5/16/2010	PRB	Hunt	7	0																						
5/18/2010	PRB	Hunt	7	1	17	Y	2:00-3:00	BAEA	A	270	350					325	325	325	325	325	325	CS, G	NE	:00	3:45	high circle on thermal over Hunt Ridge; glides away toward Medux
5/20/2010	PRB	Hunt	7	0																						
5/23/2010	PRB	Hunt	7	0																						
5/24/2010	SPM	Hunt	6.5	0																						
5/27/2010	SPM	Hunt	7	0																						
[illegible]																										
3/16/2010	SPM	May Mtn	7	0																						
4/1/2010	SPM	May Mtn	7	0																						
4/13/2010	SPM	May Mtn	7	0																						

2010 Winter Spring Summary					
	Number of Hours	Number of Eagles	of Eagles within Project Area	Total Passage Rate	Project Area Passage Rate
Sam Drew	102.5	11	7	0.11	0.07
Hunt	101	20	11	0.20	0.11
May Mtn	21	0	0	0.00	0.00

Appendix B Table 5. Summary of Bald Eagle Observations during Summer-Fall 2010 Surveys

Date of Survey	Observer	Survey Location	Number of Individuals		Within project boundary (yes or no)	Time	Species	Age (J, Sub-A or A)	max height (m) A1	max height A1 (m)	min height (m) A2	max height (m) A2	min height (m) A3	max height (m) A3	min height (m) B	max height (m) B	min height (m) C	max height (m) C	min height (m) D	max height (m) D	Flight Behavior Code	Minutes over ridge below max turbine height	Behavioral notes
6/16/2010	SPM	Sam Drew					NO EA																
7/7/2010	NED	Sam Drew					NO EA																
7/20/2010	SAB	Sam Drew	1		N	12:00-1:00	BAEA	A									90	100			CS, LS		only glimpsed; low down in valley; chased and dived at by unidentified buteo
7/26/2010	JLC	Sam Drew					NO EA																
7/27/2010	NED	Sam Drew					NO EA																
8/10/2010	PRB	Sam Drew	1		N	10:00-11:00	BAEA	A											200	900	CS, G		well outside project area; circling high in big thermal, being chased by unidentified raptor over Skitacook area moving away southwest
8/11/2010	NED	Sam Drew					NO EA																
8/24/2010	NED	Sam Drew	1		Y	2:00-3:00	BAEA	A	80	350					80	100					G, CS	2:45	first seen flying northeast along ridge just to southeast of observation site, then flew down below treeline. within 30 minutes bird was seen circle-soaring over ridge climbing up to a height of ~350 m then gliding off to the northeast until it was beyond visible range with 10x binoculars.
8/31/2010	PRB	Sam Drew					NO EA																
9/1/2010	LSC	Sam Drew					NO EA																
9/13/2010	NED	Sam Drew	1		Y	10:00-11:00	BAEA	J	30	150											G, CS	1:10	moving along ridge at about 30-50m then climbing and continued off to southwest
9/15/2010	LSC	Sam Drew	1		N	11:00-12:00	BAEA	J											100	150	PF		observed for a fraction of a second being attacked by a raven
9/16/2010	NED	Sam Drew	1		N	10:00-11:00	BAEA	A							40	60	50	100			LS, G		linear soaring along northwest of ridge; brief glimpse through trees
10/4/2010	JSP	Sam Drew	1		Y	2:00-3:00	BAEA	SA					75	150							LS	0:10	
10/5/2010	LSC	Sam Drew	1		Y	1:00-2:00	BAEA	A	200	300					200	300	300	400	300	400	LS	0:00	may not be migrating, could be a local because of the local nests. very far away and difficult to see. clearly an adult.
10/6/2010	JSP	Sam Drew	1		N	12:00-1:00	BAEA	SA							25	80					LS		
10/8/2010	JSP	Sam Drew					NO EA																
10/12/2010	LSC	Sam Drew	1		Y	12:00-1:00	BAEA	U			150	200			200	250					CS	0:00	too far away to be sure of age; may be an adult; flew very high in wide circles
10/12/2010	LSC	Sam Drew	1		Y	12:00-1:00	BAEA	A	300	350					300	350	350	400	400	450	CS,G	0:00	bald eagle may be observation #4 reappearing; an adult. Flew very high in wide circles and glided north, then joined by three unknown raptors. Two may have been buteos, the other may be an adolescent eagle. All four had the same flight path. The unknown raptor which may be another eagle dive bombed the eagle a couple of times.
10/13/2010	LSC	Sam Drew					NO EA																
10/14/2010	JSP	Sam Drew	1		N	12:00-1:00	BAEA	A											300	400	LS		
10/14/2010	JSP	Sam Drew	1		N	12:00-1:00	BAEA	A											250	300	LS		
10/14/2010	JSP	Sam Drew	1		Y	2:00-3:00	BAEA	SA	150	450											LS	0:00	
10/14/2010	JSP	Sam Drew	1		N	2:00-3:00	BAEA	SA									200	350			G		
6/17/2010	SPM	Hunt					NO EA																
7/7/2010	SPM	Hunt					NO EA	A															
7/20/2010	NED	Hunt					NO EA																
7/26/2010	NED	Hunt					NO EA																
7/27/2010	JLC	Hunt					NO EA																
8/10/2010	NED	Hunt					NO EA																
8/11/2010	PRB	Hunt					NO EA																
8/24/2010	LSC	Hunt	1		Y	2:00-3:00	BAEA	A	80	350					80	100					G, CS	2:45	
8/31/2010	LSC	Hunt					NO EA																
9/1/2010	NED	Hunt					NO EA																
9/13/2010	LSC	Hunt	1		Y	10:00-11:00	BAEA	J	30	150											G, CS		
9/15/2010	NED	Hunt	1		Y	11:00-12:00	BAEA	A					80	100	100	200	200	230			PF, CS, G		from ridge to west, flew to valley between observation locations; circle-soared a few times moving back toward Hunt then off to the northeast
9/15/2010	NED	Hunt	1		N	11:00-12:00	BAEA	A							130	160	160	180			LS		escorted by two common ravens; steady flight along slope to northeast
9/15/2010	NED	Hunt	1		Y	11:00-12:00	BAEA	J							150	180	180	250			PF	0:00	harassed by common ravens and chased all over
9/16/2010	LSC	Hunt	1		N	9:00-10:00	BAEA	J or SA									80	90	80	100	LS, G		too far away to determine if it was a juvenile or sub adult; not an adult. hardly flapped. watched for 5 minutes before it was too far to see. does not appear to be migrating; gliding the whole time over the valley and used the updrafts near ridge to linear soar
9/16/2010	LSC	Hunt	1		Y	1:00-2:00	BAEA	A			50	60			60	70	70	80	80	100	G, CS		attacked by a raven; flying high up to the east. no flapping
9/17/2010	LSC	Hunt					NO EA																
10/4/2010	LSC	Hunt					NO EA																
10/5/2010	JSP	Hunt					NO EA																
10/6/2010	LSC	Hunt	1		N	12:00-1:00	BAEA	SA							25	50					LS		see JSP date for observation # 4 BAEA. observed bird at a great distance and JSP called to see if it was visible simultaneously. observed for an instant; not enough time to gather data
10/8/2010	LSC	Hunt	1		N	10:00-11:00	BAEA	A							20	25	30	50	40	70	LS,CS,G	0:00	flying near three ravens which may have been harassing it. flew low over Drew Mountain and disappeared over the ridge; may be a local from Drew's Lake (Meduknekeag Lake) nests or could be migrating
10/8/2010	LSC	Hunt	1		Y	3:00-4:00	BAEA	A	30	70											PF, LS	0:00	flying away from a group of ravens. may be observation #1 reappearing and therefore may not be migrating, lost sight while flying along the ridge with treas behind it
10/13/2010	JSP	Hunt					NO EA																
10/14/2010	LSC	Hunt	1		Y	12:00-1:00	BAEA	A			20	25			50	70	70	90	120	300	CS,G	8:00	observation #2 joined by observation # 3 after four minutes as indicated on the map. Both circle-soared higher and higher over the valley then gliding in the direction of Meduknekeag Lake, separating eventually as shown on map.
10/14/2010	LSC	Hunt	1		Y	12:00-1:00	BAEA	A			20	25			50	70	70	90	120	300	CS,G	2:00	
10/14/2010	LSC	Hunt	1		Y	2:00-3:00	BAEA	SA	120	150	200	300			200	220	220	250	250	300	LS,CS,G	0:00	distance and cloud backdrop made determining the age difficult. Also observed by JSP and thought to be a sub-adult. Not one of the adults observed previously; did not fly towards Meduknekeag Lake.

2010 Summer Fall Summary

	Number of Hours	Number of Eagles	Number of Eagles within Project Area	Total Passage Rate	Project Area Passage Rate
Sam Drew	140	15	7	0.11	0.05
Hunt	140	13	7	0.09	0.05

Appendix C
Summary of Best Available Information about Interaction between Bald Eagles and Wind Turbines

Raptor and Bald Eagle Mortality at Existing Wind Facilities

Available information on the mortality of raptors, including eagles, from wind facilities include: results of post-construction mortality surveys in the US; comparison of site-characteristics of facilities with high numbers of fatalities in other countries; and results of surveys conducted pre- and post-construction at the same facilities.

The potential collision risk to bald eagles from wind facilities is influenced by the eagles' use of the ridgeline topography to catch updrafts for soaring, as well as potential crossing of the ridgeline during foraging. Outside of previous and ongoing studies at California's Altamont Pass, publicly-available studies of mortality at operating wind farms have consistently documented exceptionally low raptor mortality rates throughout North America. Conversely, the historic cause and effect of raptor mortality at Altamont is well documented (Smallwood and Thelander 2007, GAO 2005). Mortality rates found at onshore wind developments, outside of Altamont, documented 0 to 0.07 raptor fatalities/turbine/year from 2000-2004 (GAO 2005). A subsequent technical review of wind energy impacts by The Wildlife Society (Arnett et al. 2007) documented a combined mean rate of 0.03 raptors per turbine at operating wind farms. Each of the studies incorporated in The Wildlife Society review integrated scavenger removal and searcher efficiency biases. At 14 wind projects in the US (outside California), over 15,000 turbine searches have been conducted over a 15-year period. Less than 50 raptor fatalities have been reported (Table 3-1; 1994-2009); none of which were bald eagles.

Species found during the mortality searches were common to the area and occurred during both migratory and breeding seasons. Despite regular and ongoing reviews, there have not been any bald eagle fatalities reported at an operating wind facility in the US (Erickson and Arnett 2008).[1],[2]

In addition to reported fatalities at sites in the US, fatalities of related eagle species have been documented at several facilities outside the US. As part of this review, Stantec investigated fatalities of eagle species closely related to the bald eagle, such as the sea eagle *(Haliaeetus albicilla)* and wedge-tailed eagle *(Aquila audax)*. Fatalities appear to be most common in settings that are inherently far more risky than this Project area. For example, most of these facilities are located in coastal areas close to, and in one case, surrounding, high densities of breeding and resident eagles. Facilities in Norway, Australia, and Japan also include much larger numbers of turbines than are proposed at this project (Table 3-2).

[1] As of March 2010, two reports of bald eagle fatality have been documented in Canada associated with a wind facility. In November 2004, an adult bald eagle was recovered by facility personnel at the Castle River Wind Farm in southern Alberta. The cause of death was not determined, but the bird was found between two adjacent turbines. This facility includes 66 older-style turbines located in cultivated fields or heavily grazed native pasture; these turbines are spaced 100-150 meters apart and have a maximum height of 73 m, compared to 120 to 150 m for modern turbines. In June 2009, anecdotal reports of a fatality of a bald eagle were reported at a wind facility in Ontario. However, no information is currently publicly available for this incident. The facility includes 66 turbines and is within two miles of Lake Erie in a well-documented fall raptor migration corridor. A Hawk Watch site within 20 miles averages 37,000 raptors per fall season.

[2] Due to differences in turbine and monopole (tower) type, design, spacing, and rotor speed, along with differences in raptor use, the patterns of raptor fatality in California are considered unique among US installations, particularly when compared with results at facilities with modern turbine designs.

Table 3-1. Available raptor mortality data reported at wind farms in the U.S. (outside of California) from 1994-2009

Location	Habitat Type (# Turbines)	Study period	Search Interval	Number of fatalities and species	Dates of carcass discovery	Reference
Buffalo Ridge, MN	agricultural grassland (73)	1994-1995	30-50 weekly	0	n/a	Osborn *et al.* 2000
Buffalo Ridge, MN	agricultural grassland (138)	1996-1999	30 per 14 days	1 red-tailed hawk	n/a	Johnson *et al.* 2002
Searsburg, VT	forested ridge (11)	1997	11 total (4 per search) 2-6 days per month	0	n/a	Kerlinger 2002
Foote Creek Rim, WY	shrub-steppe grassland (69)	1998-2002	35 searched once every 2 weeks	1 northern harrier, 3 American kestrel, 1 short-eared owl	Northern harrier (4/19/99); American kestrel (5/12/99, 10/12/99, 7/19/00); short-eared owl (09/28/00)	Young *et al.* 2003
Vansycle, Umatilla County, Oregon	agricultural grassland (38)	1999	*All turbines* searched each 28-day period	0	n/a	Erickson *et al.* 2000
Stateline, WA/OR	agricultural grassland (454)	2001-2003	120-150 total	9 red-tailed hawk, 3 American kestrel, 1 ferruginous hawk, 1 Swainson's hawk, 1 short-eared owl	Total raptor fatalities 2002: 1 in June, 2 in August, 2 in September, and 1 in October; 2003: 1 in May, 1 in June, 3 in July, 2 in October	Erickson *et al.* 2004
Somerset County, PA	agricultural grassland (8)	2000	n/a	0	n/a	Kerlinger 2006
Nine Canyon, WA	shrub-steppe grassland (37)	2002-2003	1 x 2 weeks	1 American kestrel, 1 short-eared owl	American kestrel (11/18/02), short-eared owl (4/7/03)	Erickson *et al.* 2003
Klondike, OR	shrub-steppe grassland (16)	2002-2003	1 x month	0	n/a	Johnson et al. 2003
Mountaineer, WV	forested ridge (44)	2003	2 x per week	1 red-tailed hawk, 2 turkey vultures	each between 04/04/03 - 04/27/03, 06/02/03 -06/24/03, 07/26/03 - 07/29/03, and 08/18/03 - 11/22/03	Kerns and Kerlinger 2004
Mountaineer, WV	forested ridge (44)	2004	22 daily, 22 weekly	1 sharp-shinned hawk, 1 turkey vulture	both between 07/31/04 - 09/11/04	Arnett *et al.* 2005
Meyersdale, PA	*forested ridgeline (20)*	*2004*	10 daily, 10 *weekly*	*0*	*n/a*	*Arnett et al. 2005*
Top of Iowa, Iowa	agricultural grassland (89)	2004	26 every 3 days	1 red-tailed hawk	red-tailed hawk (4/01/04 - 12/10/04)	Kolore *et al.* 2005
Buffalo Mountain, TN	open/shrubland (18)	2005	18 of 18 every week, every 2 weeks, or every 2-5 days	0	n/a	Fiedler *et al.* 2007
Kewaunee County, Wisconsin	agricultural grassland (31)	1999-2001		0	n/a	Howe *et al.* 2002
Maple Ridge, NY	woodland, agricultural grassland (120)	2006	10 every 3 days, 30 7 days, 10 daily	1 American kestrel	American kestrel (7/06)	Jain *et al.* 2007
Maple Ridge, NY	woodland, agricultural grassland (195)	2007	64 weekly	1 American kestrel, 5 red-tailed hawk	red-tailed hawk (1 found 8/07, 2 found 9/07) // (1 sharp-shinned hawk and 2 red-tailed hawk dates not reported)	Jain et al. 2008
Maple Ridge, NY	woodland, grassland, agricultural (120)	2008	64 weekly	1 American kestrel, 2 sharp-shinned hawk, 1 Cooper's hawk	n/a	Jain *et al.* 2009a
Mars Hill, ME	forested ridgeline (28)	2007	2 of 28 daily, 28 of 28 weekly, seasonal dog searches	0	n/a	Stantec 2008
Mars Hill, ME	forested ridgeline (28)	2008	28 of 28 weekly, seasonal dog searches	1 barred owl	barred owl (4/11/08)	Stantec 2009
Mt. Storm, WV	forested ridgeline (82)	2008	18 weekly, 9 daily	2 turkey vulture	9/25/2008 and 10/13/2008	Young *et al.*, 2009
Lempster, NH	forested ridgeline (12)	2009*	4 daily	0	n/a	Tidhar 2009
Clinton, NY	agricultural, woodland (67)	2008	6 daily, 6 every 3-days, 7 every 7-days	1 broad-winged hawk	May	Jain et al. 2009b
Ellenburg, NY	agricultural, woodland (54)	2008	6 daily, 6 every 3-days, 6 every 7-days	1 broad-winged hawk	June	Jain et al. 2009c
Bliss, NY	agricultural, woodland (67)	2008	8 daily, 8 every 3-days, 7 every 7-days	3 red-tailed hawk, 1 sharp-shinned hawk	1 fatality in June, 1 fatality in August (2 incidental raptor dates not reported)	Jain et al. 2009d
Stetson, ME	forested ridgeline (38)	2009	19 weekly	1**	red-tailed hawk (7/27/09)	Stantec 2009b
Cohocton and Dutch Hill, NY	agricultural (50)	2009	5 daily, 12 weekly	1	sharp-shinned hawk (7/8/09)	Stantec 2009c
Munnsville, NY	agricultural (23)	2008	12 weekly	2	red-tailed hawk (7/16 and 8/14)	Stantec 2009d

*Results of spring interim report, study period April 20 to June 1.
**Fatality was result of electrocution at a riser pole of the electrical collection system

Table 3-2. *Comparison of known eagle mortality factors at wind facilities outside United States*

Site	Landscape Conditions	Mortality	Site characteristics which influence mortality
Smola, Norway	coastal island	36 white-tailed sea eagles between 2005 and 2010	68 turbines located in area identified as International Bird Area with the highest density of white-tailed sea eagles in the world (300 individuals, 86 breeding pairs, 13-16 pairs within facility area prior to operation). The relatively small, off-shore island essentially lacks tree or shrub vegetation and consequently supports a high concentration of eagles which nest on the ground directly within the rows of turbine strings.
Tarifa, Spain	near the Straits of Gibraltar	2 short-tailed eagles over 1-year survey period (1993-1994)	Nearly 700 turbines (including lattice-tower models similar to Altamont) are located near a main point of migratory passage for several hundred thousand raptors annually.
Woolnorth, Tasmania	coastal bluff	14-18 wedge-tailed eagles between 2003 and 2008	62 turbines located on costal bluff and wedge-tailed eagle nests are located within 0.3 miles of turbines.
Starfish, Australia	coastal bluff	2 wedge-tailed sea eagles in 2004	23 turbines situated on a high coastal bluff
Hokkaido, Japan	coastal island	6 white-tailed sea eagles from 2004-2007	Almost 250 turbines are located in coastal area, along important migration route for sea eagles.

Note: This information is based on a literature review of mortality events from various sources. Mortality of white-tailed sea eagles has also been reported at facilities in Germany and Sweden, but very limited information is available; a request for further details has been submitted. Reports of other mortality were either not facility-specific or could not be substantiated thru an extensive search of news articles, peer-reviewed literature and general web searches.

There are currently three sites in the Northeast for which pre- and post-construction raptor survey data and mortality data are available: 1) Maple Ridge Wind Project in Lewis County, NY (pre-construction surveys formerly referred to site as Harrisburg; 2) Mars Hill Wind Project in Aroostook County, ME; and 3) Lempster Wind Project in Sullivan County, NH. Post-construction raptor surveys were performed during the same year as mortality surveys in 2009 at the Stetson Wind Project in Penobscot and Washington Counties, ME. Raptor avoidance behaviors were observed at this site.

At Maple Ridge, NY, pre-construction surveys in fall 1998 documented a total of 554 raptors during 68 total hours of survey from the beginning of September to October (seasonal passage rate of 8.1 birds/hour). The most commonly observed raptor species during the pre-construction surveys were turkey vulture (n=294) and American kestrel (n=84). There were two New York state listed species observed, osprey (n=2) and northern harrier (n=52). The mean flight height of raptors was 48 m above ground level (Cooper and Mabee 1999), which is below the rotor swept area of the turbines. Two years

of post-construction mortality searches at Maple Ridge indicated relatively low raptor mortality, with an estimate of 0.07 American kestrels/turbine/year in 2006 (Jain et al. 2007), and an estimate of 0.41 red-tailed hawks per turbine per year in 2007 (Jain et al. 2008). No eagle fatalities were documented during post-construction surveys at the project.

At Mars Hill, ME, pre-construction surveys in fall 2005, documented a total of 115 raptors during 42.5 hours of survey from the beginning of September to mid-October (the seasonal passage rate was 1.52 birds/hour); spring 2006 results included a total of 64 raptors during 60.25 hours of survey between mid-April and late May (seasonal passage rate of 1.06 birds/hour). The most commonly observed raptor species during the fall surveys were sharp-shinned hawk (n=40) and red-tailed hawk (n=26) and, during the spring surveys were osprey (n=22) and turkey vulture (n=11). Maine state listed species observed included peregrine falcon (n=2, fall), and bald eagle (n=8, fall; n=4, spring). The seasonal percentage of birds below the maximum rotor-swept height of 120 meters (m) was 42 percent in the fall and 48 percent in the spring (Stantec 2008). Two years of concurrent raptor behavior and post-construction fatality surveys at Mars Hill were subsequently conducted in 2007 and 2008 to help characterize raptor use of the site during active operations. These observations indicated a continued use of the project area by a variety of migrant and resident raptors, including bald eagle, with documentation of direct turbine avoidance. These observations, correlated with minimal raptor fatalities (one owl fatality in two years of study, and that could have been a natural winter kill during the severe 2007-2008 winter conditions), strongly suggest a low raptor collision risk despite continued use of the area by raptors (Stantec 2008, Stantec 2009). No eagle fatalities were documented during post-construction surveys at the project.

At Lempster, NH, pre-construction surveys in fall 2005, documented a total of 264 raptors during 80 hours of survey (the seasonal passage rate was 3.3 birds/hour); spring 2006 results included a total of 102 raptors between mid-April and late May (seasonal passage rate of 1.3 birds/hour). The most commonly observed raptor species during the fall surveys were broad-winged hawk (n=170) and sharp-shinned hawk (n=49) and, during the spring surveys again were broad-winged hawk (n=39) and sharp-shinned hawk (n=20). The seasonal percentage of birds below the maximum rotor-swept zone was 60 percent in the fall and 56 percent in the spring (Woodlot 2007). One year of post-construction fatality surveys at Lempster were subsequently conducted in 2009 to determine the estimates of the overall annual mortality rate of the project. This monitoring did not cover raptor use of the project area after construction; however it did document species specific fatalities with adjustments for searcher efficiency and scavenger removal rates (Tidhar 2009). No raptor fatalities were documented during 2009 post-construction surveys at the project.

At Stetson, ME, post-construction raptor surveys occurred in conjunction with the post-construction mortality surveys. A total of 79 raptors (34 in spring; 45 in fall) during 70 hours of survey were observed for both spring and fall survey seasons (Stantec 2009b). The seasonal passage rate was 1.13 birds/hour. The most commonly observed raptor species were red-tailed hawk (n=26) and turkey vulture (n=19). The seasonal percentage of birds below the maximum turbine height was 67 percent for the spring and fall surveys combined. During post-construction mortality surveys, one red-tailed hawk was found, however it was electrocuted by a riser pole of the electrical collection system. No raptor fatalities were documented under turbines.

Flight Behaviors

Available information on the flight behavior of eagles and interaction with wind turbines includes results of behavior surveys conducted at multiple facilities, reported avoidance rates, and evaluation of factors that contribute to specific flight behaviors.

At proposed (and now existing) wind facilities in the east, it has generally been the trend that the majority of raptors observed have been below the height of the proposed turbines; the range of birds below the maximum height of the towers has been between 9 to 89 percent (Stantec 2009). Despite relatively low flight heights of raptors observed, studies have also documented high turbine collision avoidance behaviors at modern wind facilities (Whitfield and Madders 2006, Chamberlain et al. 2006). These studies found that because most raptors are diurnal, raptors may be able to visually, as well as

acoustically, detect turbines during periods of fair weather. Additionally, periods of intensified raptor movements, such as days during peak migration, are often associated with the clear weather conditions that follow certain frontal systems.

At the Stetson Wind Project during spring and fall raptor surveys, a total of 79 raptors were observed in the Project area; 46 of these birds were documented flying below maximum turbine height. Of those 46 birds, 54 percent of birds (n=25) occurred within 51 to 100 m from the turbines. Of these birds within turbine areas at heights below 119 m, 39 birds exhibited no observable reaction to turbines as they occurred over the Project ridge. Only two raptors observed during migration surveys exhibited turbine-avoidance behaviors: a turkey vulture and a sharp-shinned hawk, both on April 27. Incidental observations of raptors during the mortality survey included additional instances of raptor turbine-avoidance behaviors. Out of 47 incidental observations, seven raptors exhibited turbine-avoidance behaviors. For these seven observations, raptors made slight changes to their flight paths as they approached spinning turbines. For all nine observations of turbine-avoidance behaviors, including observations made during migration surveys and incidental observations, the turbines closest to these birds were spinning. No raptors observed came into contact with the turbines (Stantec 2009b).

While the ability of raptors to avoid turbines likely depends on a variety of factors, limited studies have attempted to quantify or estimate raptor avoidance rates, either through on-site observation or modeling. Birds presumably avoid encountering turbines by seeing the blades or detecting the motion of spinning blades, or by acoustically detecting them (Dooling 2002). Avian turbine avoidance rates have been calculated, using a model developed by Whitfield and Madders (2006) known as the "Band Model," at several existing wind farms in the US where mainly geese and raptor species were estimated to have avoidance rates greater than 95 percent (Fernley et al. 2006). Vultures, while often common in and around wind facilities, have also collided with turbines infrequently (NRC 2007). Golden eagles were reported to have an estimated turbine avoidance rate of 99.5 percent during surveys at a US facility (Chamberlain et al. 2006).

Bald eagle observations have regularly been documented at operational facilities during raptor surveys. Results are available from surveys conducted at five operational facilities: At Buffalo Ridge, MN, 51 bald eagle observations were documented during four years of monitoring, primarily during spring migration. Direct observations of turbine avoidance behavior by raptors were made by researchers documenting movement patterns and flight behaviors of birds at the Buffalo Ridge facility in Minnesota. Birds seen flying through turbine strings often adjusted their flight when turbine blades were rotating and typically made no adjustments when turbines were not operating, supporting the theory that birds can detect blade movement by sight or sound. American kestrels were often seen at the height of the rotors and within 15 m (50 feet [']) of turbines. However, no kestrels were found during four years of fatality searches at this site. Buteos were often observed at the height of the rotors, but were infrequently seen within 31 m (100') of the towers. No buteo morality was reported at this facility (Osborn et al. 1998). No bald eagle fatalities were reported at any project in the US

At Foote Creek Rim, WY, three bald eagle nests are located within 10 miles of the project and post-construction observations documented 43 bald eagle observations during use surveys. In addition, at the Foote Creek Rim facility, 30 golden eagle nests were found within 10 miles of the project and over 2000 golden eagle observations recorded, yet no eagle fatalities were documented during a four-year period (Young et al. 2003).

At Erie Shores, ON, adults and juvenile eagles were seen perched within 200 m of active turbines and on a few occasions they were observed flying closer than 100 m of rotating blades. Over the course of two years, bald eagles were noted flying past active turbines within 300 m on about 170 occasions. Most of these were along the Lake Erie shore, where they routinely soared past at less than 200 m away but on five to six occasions they were observed less than 50 m from turning blades. A 2008 use study included over 3,000 observations of raptors passing within 300 m of the turbine, including 170 bald eagle observations (James 2008).

At Mars Hill, ME, post-construction monitoring results have demonstrated that migrant and resident raptors continue to use the Project area. Surveys also documented direct turbine avoidance by eagles, very similar to the behavior observed at Buffalo Ridge. Two years of post-construction monitoring were conducted in 2007 and 2008. No bald eagle fatalities have been documented in nearly three years of operation (Stantec 2009). At Lempster, NH, operation started in winter 2009. Post-construction fatality monitoring is ongoing; to date, no bald eagle fatalities have been documented.

The fact that post-construction studies have shown very few raptors being killed by turbines, and that fatalities are distributed between breeding and migration seasons, demonstrates the difficulty in determining which specific factors (flight behaviors, other seasonal behaviors, weather conditions, prey abundance and availability, raptor density, etc.) may cause raptors to collide with wind turbines at a given site. It may be more apparent why they are generally avoiding turbines. Raptor mortality from operational wind facilities in the US may be low due to the life history characteristics of raptors. In the northeast, migrating raptor species (not including owls) are diurnal animals, they are active almost entirely during daylight hours (Wheeler 2003) and their preferred prey species are generally small to medium-sized mammals, fish, and birds, which are hunted from hundreds of feet away. It requires excellent vision to hunt and capture small prey at these distances. The day-time habits and good vision of raptors may allow them to see turbines and avoid them (Chamberlain 2006) and eagles are less likely to fly during periods of high winds. This behavior has been confirmed by direct observations of raptors at some operating wind projects in the US (Chamberlain 2006, Stantec 2008, 2009).

Nest Displacement

Limited data exist regarding raptor displacement from wind farms in the eastern US. Data from existing facilities in the west and upper mid-west indicate that raptors continue to use the area surrounding wind developments although breeding habitat displacement was observed at a wind farm in Minnesota and at a wind farm in Ontario.

For three years after construction of a facility in Wyoming, a pair of golden eagles successfully nested within 0.8 km (0.5 mi) of the facility (NRC 2007). A Swainson's hawk nested within 0.8 km of a wind farm in Oregon (NRC 2007). Golden eagle breeding territories were monitored in 2000 and 2005 at a facility in California, and the same nesting territories were used during both years (NRC 2007). Within two miles of the Stateline facility in Oregon and Washington, raptor density remained unchanged during a two year post-construction study (NRC 2007).

After development of the Buffalo Ridge Wind Farm, raptors continued to nest in the area surrounding the Project; however, no nests were found in similar habitats within the 32 sq. km (19.9 sq. mi) facility (NRC 2007). Observed raptors, however, continued to use the Project area while foraging or flying. American kestrels were often seen flying within 15 m (49.2') of turbines (Osborn et al. 1998). However, buteos were infrequently seen within 31 m of the towers (Osborn et al. 1998). At a facility in Ontario, a pair of bald eagles nested in a wooded area within the project boundary, approximately 400 m from the turbine site. During turbine construction in winter, the pair moved to a new nest approximately 900 m from the turbine site. The pair was observed flying in the wind facility during all seasons and successfully raised two eaglets. During the next year, a pair returned to occupy the new nest but it failed early for unknown reasons. In the third year, the pair rebuilt and reoccupied the original nest. There were also two Cooper's hawk nests within 180 m of turbines and one red-tailed hawk nest within 60 m of turbine construction (James 2008).

In seven of the ten states with the highest megawatts (MW) of developed wind energy, there are over 150 bald eagle breeding pairs, and in one case, over 1,000 (Table 3-3).

Table 3-3. Estimated Bald Eagle Breeding Pairs in the ten states with the highest installed wind capacity

State	Megawatts of installed wind generation capacity	# of breeding pairs of bald eagles	# of bald eagle fatalities attributed to wind turbines
Texas	7907	156	0
Iowa	2883	200	0
California	2653	200	0
Minnesota	1803	1312	0
Washington	1479	848	0
Oregon	1363	470	0
New York	1261	110	0
Colorado	1068	42	0
Kansas	1014	23	0
Illinois	915	100	0
Maine	104	414	0

Sources: AWEA installed wind capacity; USFWS, April 2007; Erickson and Arnett 2008

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Appendix 7-4
2010 Bald Eagle Aerial Flight Survey Memo

Memo

Stantec

To:	Geoff West First Wind	From:	Bryan Emerson Stantec Consulting
File:	195600518	Date:	June 23, 2010

Reference: ***Spring 2010 Aerial Survey***
Maine GenLead 115-Kilovolt Transmission Line Project

As requested, Stantec Consulting (Stantec) conducted aerial surveys for bald eagle (*Haliaeetus leucocephalus*) nests, osprey (*Pandion haliaetus*) nests, and great blue heron (*Ardea herodias*) rookeries[1] in the vicinity of the proposed Maine GenLead 115-kilovolt Transmission Line Project (project). The survey area included an approximately 0.25-mile wide corridor along the proposed transmission line route between Chester and Oakfield, Maine. Prior to the survey, Stantec reviewed information provided by the Maine Department of Inland Fisheries and Wildlife (MDIFW) regarding known active and historic bald eagle nest locations and documented great blue heron nesting activity in the vicinity of the project area. Stantec also consulted with Charlie Todd of the MDIFW, who confirmed that the aerial survey was performed at an appropriate time of year and employed methods consistent with the MDIFW and U.S. Fish and Wildlife Service (USFWS) aerial survey protocol. In compliance with USFWS National Bald Eagle Management Guidelines (May 2007), Stantec also notified Mark McCullough of the USFWS Maine Field Office that flights were planned in this area and that Stantec was coordinating with MDIFW on the timing and methods of the flights.

Survey Methods

Stantec conducted two aerial surveys. The first flight was conducted on May 5, 2010. The purpose of the first flight was to identify new nests and to assess eagle nesting activity at known nest locations within the project area. The timing of the first flight was chosen in consultation with MDIFW to correspond with the time period when bald eagles are actively incubating eggs. The second flight was conducted on June 9, 2010, to check the status of active nests in the project area and to perform a second search on areas where a nest was suspected but not seen during the first flight. The timing of the second flight was chosen to correspond to the time period when eaglets have hatched and are visible in the nest to determine hatching success.

The surveys consisted of two low altitude passes, approximately 500 feet above ground level, along the proposed corridor in both directions. Stantec surveyed the shoreline of the Penobscot River for a distance of approximately one mile upstream and downstream of the proposed crossing. Other waterbodies and bogs, wetlands, and flowages within the corridor and immediately adjacent to the corridor were also surveyed. These waterbodies included Mattaseunk Lake, Molunkus Lake, Reed Pond, and the East and West Branch of the Mattawamkeag River. The shorelines of the waterbodies were surveyed for bald eagle or osprey nest sites, as well as for great blue heron rookeries. Incidental observations of adult and sub-adult bald eagles were also recorded.

Survey Results

Stantec identified several active bald eagle nests in the vicinity of the project area, but none within the Project corridor itself. Stantec identified two active bald eagle nests along the Penobscot River, one upstream of the proposed crossing and one downstream. The

[1] A "rookery" is a nesting colony of great blue heron nests generally located in woodlands or in swamps, bogs, and other large, open wetland areas. In Maine, rookeries range in size from 1 to 120 nests, with the average between 8 and 12 nests according to MDIFW. Individual nests are approximately 1-meter in size and can be found in either hardwood or softwood trees. Nests are generally located in the tops of trees to avoid predators, but multiple nests can be found in a single tree.

downstream nest was located on the northeast shore of the river, approximately one mile from the proposed crossing. This nest is likely an alternate location for the known bald eagle nest mapped on the west side of the river (MDIFW Nest #190). One adult bald eagle was seen in the nest in an incubating position. Stantec also located an old bald eagle nest on the west side of the river, which matched the location of Nest #190. Stantec observed a pair of great horned owls (*Bubo virginianus*) occupying the old bald eagle nest. The upstream bald eagle nest was located approximately two miles from the proposed crossing and was also found to be active with one adult bald eagle observed in the nest in an incubating position. This nest location corresponds to a known nest mapped by MDIFW (Nest #387). Stantec observed two adult bald eagles and one sub-adult bald eagle flying in the vicinity of the existing dam on the Penobscot River, just upstream of the proposed crossing location. Stantec also located a known bald eagle nest on Molunkus Lake (MDIFW Nest #299) and found the nest to be active with an adult bald eagle sitting in the nest, possibly in a brooding position. No other bald eagles or nests were observed in or adjacent to the Project corridor.

Stantec identified 11 osprey nests along the proposed project corridor. Each osprey nest was located on existing poles associated with the Maine Electric Power Company (MEPCO) transmission line. Ten of the 11 nests were found to be active with adult osprey sitting on the nests in an incubating position. One of the active nests contained a hatched chick. The locations of the nests are shown on Figure 1. No great blue heron rookeries were observed in the project area. Stantec also observed a northern harrier (*Circus cyaneus*) flying along the edge of a large wetland within the existing MEPCO right-of-way in Glenwood Plantation. Northern harrier is listed as a Species of Special Concern by MDIFW.

During the second flight, Stantec surveyed the active bald eagle nest locations identified during the first flight. At the Penobscot River crossing, the nest downstream of the crossing (Nest #190) was active with two eaglets observed in the nest and an adult bald eagle perched next to the nest. The nest upstream of the crossing (Nest #387) was active with at least one eaglet in the nest and an adult eagle perched next to the nest. Nest 299 on Molunkus Lake was found to be empty, and no eaglets or adult eagles were seen in or near the nest. Stantec surveyed another known nest located in the Reed Deadwater along Macwahoc Stream (MDIFW Nest #550). The nest was active with one eaglet observed in the nest and an adult eagle perched at the nest. No new osprey nests or heron rookeries were observed during the second flight.

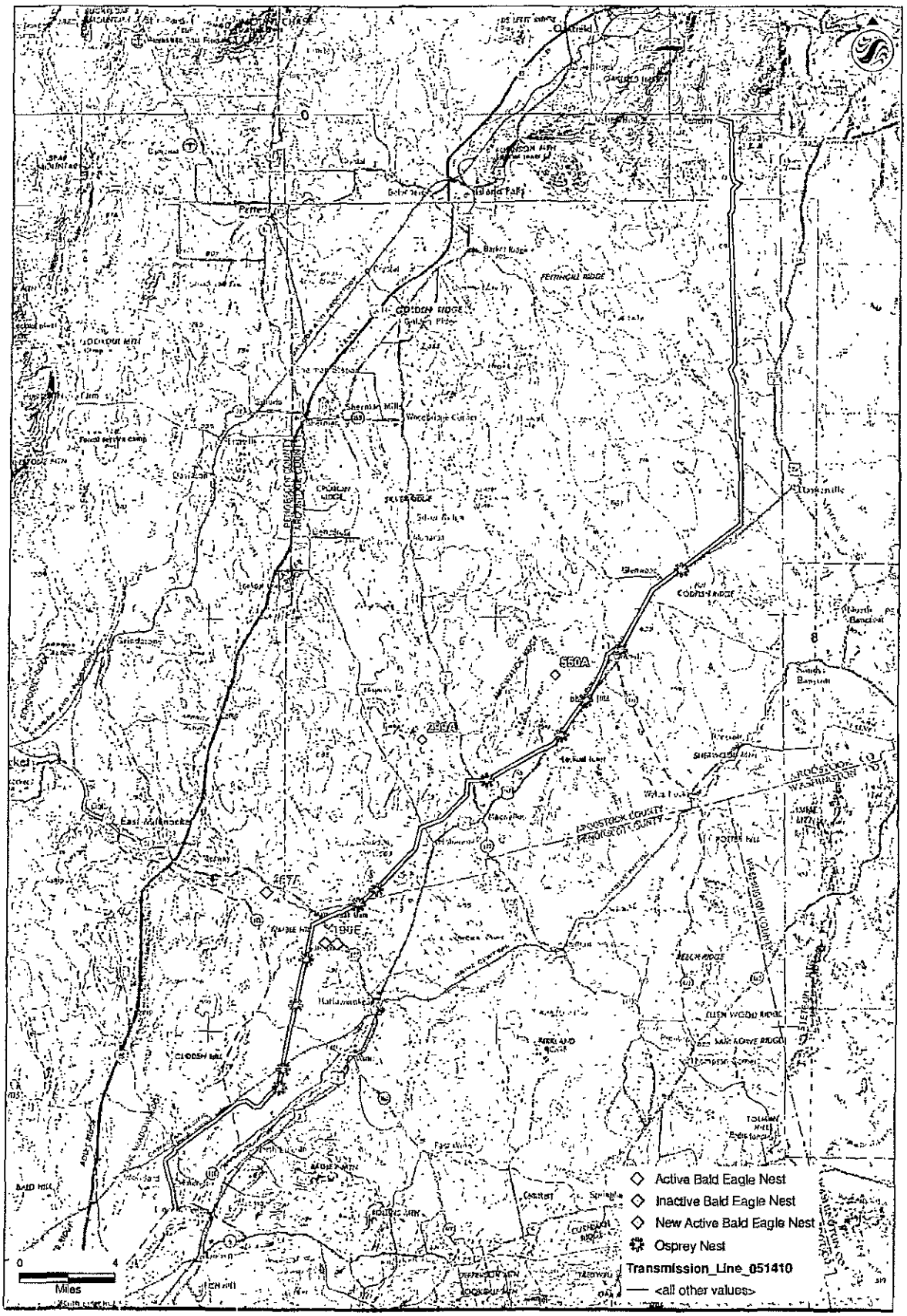
Please contact our office if you have any questions regarding the information presented in this report or if we can be of further assistance.

STANTEC CONSULTING

Bryan Emerson

Bryan Emerson
Project Manager/Wetland Scientist

Cc: Robert Roy, First Wind
Brooke Barnes, Stantec
File 195600518



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Client/Project
Maine GenLead, LLC
115kV Transmission Line
Aroostook and Penobscot Counties, Maine

Figure No.
1

Title
Oakfield Transmission Line
Eagle Survey

8/23/2010